R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Claims 1-38 have been canceled, without prejudice, and claims 39-52 have been added.

Claim 39 has been added to recite features of the present invention which were previously recited in claims 3, 19 and 22. In addition, new claim 39 incorporates part of non-elected claim 1 to further clarify the distinguishing features of the present invention.

Claim 40 has been added to recite the feature of the present invention described on page 71, lines 11-15 of the specification wherein the surface emitting laser light source and the photosensor are separated from the scale by approximately equal optical distances and are arranged on a same side of the scale.

Claim 41 has been added to recite features of the present invention which were previously recited in claims 20, 21 and 23.

And claims 42-52 have been added to recite the subject matter of claims 27, 28 and 30-38, respectively.

Proper antecedent basis has been provided for all claimed elements, and all claimed elements and the structural

relationships therebetween have been more positively and more clearly recited.

It is respectfully submitted that no new matter has been added, and that the new claims are in full compliance with the requirements of 35 USC 112, second paragraph. Accordingly, it is respectfully requested that the amendments to the claims be approved and entered and that the rejection under 35 USC 112, second paragraph, be withdrawn.

THE PRIOR ART REJECTION

Claims 3, 19-23 and 25 were rejected under 35 USC 102 as being anticipated by USP 5,680,211 ("Kaneda et al"), and claims 27-38 were rejected under 35 USC 103 as being obvious in view of USP 5,064,290 ("McMurtry et al"). These rejections, however, are respectfully traversed.

Re: New Claims 39-41

In a photosensor using a coherent light source such as a surface emitting laser, it is an important object of the present invention to prevent fluctuation of the light intensity of the light source which, as shown in Figs. 30A, 30B and 31A - 31C, would be caused by a light beam emitted from the coherent light source, reflected by a reflecting member (corresponding to the

scale of the present invention), and returned to the coherent light source. The above object may be effectively achieved by inclining the light beam relative to the surface of the scale. However, in general, a sensor which detects movement of a diffraction pattern by radiating a divergent light beam onto the scale, as in the present invention, is provided on the premise that the emitted light beam is perpendicular to the scale surface as in the prior art shown in Fig. 29.

The inventors of the present invention have found that by performing a numerical calculation, in accordance with Figs. 13A and 13B, even if the emitted light beam is greatly inclined relative to the scale surface, a diffraction pattern similar to the pattern of the diffraction grating is clearly image-formed on the light receiving surface. (In this connection, it should be noted that the term "diffraction grating" used in the present application is the same as "scale pattern having a predetermined spatial period".) Significantly, therefore, new clams 39-41 recite a structure in which a light beam is emitted to be inclined with respect to the scale, and in which the above phenomenon is used to detect the movement of a diffraction pattern by the photosensor.

By contrast, Kaneda et al merely discloses that in a structure wherein a $+1^{st}$-order diffracted light beam and a

-1st- order diffracted light beam, into which a light beam is split by a light beam-splitting element in a grating pitch direction, are synthesized with each other and made to interfere with each other by the diffraction grating. (This structure corresponds to the "synthesizing means for synthesizing a first diffracted beam ... and a second diffracted beam" claimed in Kaneda et al). And in this reference, the scale is disposed such that a light beam is emitted to be inclined relative to the scale, and the light source and synthesizing element do not cross each other in position. Therefore, it is respectfully submitted that Kaneda et al does not suggest that even if the diffraction grating is disposed inclined with respect to the light beam to be emitted, the pattern of the diffraction grating is clearly image-formed as a diffraction interference pattern on the light receiving surface.

Particularly, it should be noted that according to new claim 39, a surface emitting laser is used as the light source (with the light beam emitted therefrom having a relatively high intensity in the vicinity of its principal axis), and the light beam inclines under a condition where its principal axis is held perpendicular to the pitch direction of the diffraction grating. As shown in Fig. 15, for example, the diffraction interference pattern is thereby not displaced in the vicinity of the principal

axis of the light beam on the light receiving surface in the pitch direction, even if the distance between the scale and the light source varies. Accordingly, the sensor of the claimed present invention detects only displacement of the scale in the pitch direction, and the result of detection is not influenced by the distance between the scale and the light source. This advantage of the claimed present invention is very important for a displacement sensor when it is practically used. And it is respectfully submitted that Kaneda et al do not at all disclose, teach or suggest this advantageous effect of the present invention as recited in claim 39.

According to claim 39, when the distance between the scale and the light source varies, part of the diffraction interference pattern which is located in the vicinity of the principal axis of the light beam does not shift in the pitch direction. However, if the distance between the light source and the scale is not equal to the distance between the light receiving element and the scale, the magnification of the diffraction pattern varies. In this case, when part of the diffraction pattern which is far from the principal axis is detected by a light receiving element having a predetermined pitch, the pitch of the diffraction pattern is displaced from the predetermined pitch of the light receiving element. As a result, the level of the detection

signal (which is the sum of outputs from the light receiving element having the predetermined pitch) lowers or an error occurs in detection. In order to solve this problem, the present invention according to new claim 40 comprises a structure in which the distance between the light source and the scale is substantially equal to the distance between the light receiving element and the scale, and the light source and the light receiving element are arranged on the same side of the scale. By virtue of this structure, as shown in Fig. 17, for example, even if the distance between the scale and the light source varies, the position and pitch of the diffraction pattern on the light receiving surface do not change. That is, the part of the diffraction interference pattern which is to be detected is not limited to the part of the pattern which is close to the principal axis of the light beam, and the diffraction interference pattern does not shift over the light receiving surface. As a result, a signal of a good S/N ratio can be obtained from the light receiving element.

Accordingly, it is respectfully submitted that the present invention as recited in new claim 39, and new claims 40 and 41 depending therefrom, clearly patentably distinguishes over Kaneda et al, under 35 USC 102 as well as under 35 USC 103.

Re: Claims 42-52

According to new claims 42-52, a light beam from a coherent light source is split into light beams by a beam-splitting optical element. These light beams are then emitted onto respective different track patterns (the first and second scale patterns) and are then received by respective light receiving sensors after being reflected from or passed through the different track patterns.

By contrast, in McMurtry et al, the light reflected from a (one kind of) pattern on the scale is split into light components by the light splitting optical element. And these light components are received by different light receiving sensors. Thus, McMurty et al does not disclose, teach or suggest the features of the present invention as recited in claims 42-52 whereby a light beam is split into light beams by a beam-splitting element, the light beams are emitted onto respective different track patterns (the first and second scale patterns), and the different track patterns either reflect the light beams or allow the light beams to pass therethrough before the light beams are received by the light receiving elements. And it is respectfully submitted that the structure of McMurtry et al is entirely different from that of the claimed present invention, and that this reference does not at all disclose, teach or even

remotely suggest the structure of the present invention as recited in new claims 42-52.

Accordingly, it is respectfully submitted that the present invention as recited in new claims 42-52 also clearly patentably distinguishes over McMurtry et al under 35 USC 102 as well as under 35 USC 103.

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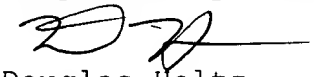
In view of the foregoing, entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,



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